Horticultural News and Research Important to American Gardeners

ARNOLD ARBORETUM RESEARCHERS IDENTIFY NEW HEMLOCK SPECIES

During the course of a 15-year research program focusing on finding hemlocks *(Tsuga* spp.) resistant to the hemlock woolly adelgid (a notorious scourge of American hemlock species), experts at the Arnold Arboretum of Harvard University in Boston, Massachusetts, made an unexpected discovery: a new, but previously misidentified, hemlock species native only to a small South Korean island.

The story began more than a century ago, when a botanist mistakenly identified hemlock trees growing on Ulleungdo, a volcanic island located some 75 miles east of what is now South Korea, as the species *Tsuga sieboldii*. Using modern genetic testing methods, the arboretum's team determined that the Ulleungdo island hemlock is actually a different species than what it had been named as, so they rechristened it *T. ulleungensis.*

Peter Del Tredici, senior research scientist emeritus at the Arnold Arboretum and a member of the team that discovered the species, notes that the Ulleungdo hemlock is resistant, but not immune, to the hemlock woolly adelgid. However, it still could be useful to breeding programs. And because it is rare enough that it may be declared an endangered species, he recommends that public gardens carefully preserve any existing trees in their collections. "*Tsuga ulleungensis* has a long way to go before it could become a landscape choice," says Del Tredici. "But botanical gardens have a big role in conservation, and this is a conservation priority."

Del Tredici and eight other researchers published their findings in the December 20, 2017 issue of *Systematic Botany*, a peer-reviewed scientific journal published by the American Society of Plant Taxonomists.

To learn more about the discovery, visit *www.thecrimson.com/article/2018/2/6/harvard-scientist-discovers- rare-tree/.*

A specimen of rare *Tsuga ulleungensis*, previously thought to be *T. sieboldii*, stands tall at the Arnold Arboretum.

HOW ANGIOSPERMS OUTPACED THEIR CONIFER AND FERN COMPETITORS

Four hundred million years ago, ferns and conifers ruled the world. But once angiosperms, or flowering plants as they are more commonly known, arrived on the scene some 200 million years ago, they stole the limelight.

Curious as to why these newcomers outshone their more ancient competitors, researchers Adam Roddy of Yale University and Kevin Simonin of San Francisco State University discovered that it relates to something unique to flowering plants called genome downsizing. By methods still unknown, angiosperms shrank the size of their genome—the genetic instructions needed to create the variety of cells that make up individual organisms. Smaller genomes led to smaller, more efficient cells that were able to multiply faster and produce more nutrients than those of their fern and conifer competitors. So through genome downsizing, angiosperms accelerated their growth rate and quickly overtook ferns and conifers as the most abundant and diverse group in the plant kingdom.

Roddy posits that ferns and conifers continue to survive in this angiosperm dominated world because they have found niches in less competitive habitats. For instance, ferns with larger genomes are often found in densely shaded forests or places where resources are scarce, whereas angiosperms tend to thrive in settings with abundant resources. The next step, Roddy explains, will be to figure out why

Despite the domination of Earth's landscapes by flowering plants, ferns and conifers still flourish in low-competition environments. Left: Cinnamon fern *(Osmunda cinnamomea).* Above right: Scots pine *(Pinus sylvestris).*

TOP: SUSAN HARDY BROWN, COURTESY OF ARNOLD ARBORETUM. BOTTOM LEFT: CHRIS EVANS, UNIVERSITY OF ILLINOIS, BUGWOOD.ORG. BOTTOM RIGHT: BILL COOK, MICHIGAN STATE UNIVERSITY, BUGWOOD.ORG

these ferns and conifers haven't employed genome downsizing like their competitors. Find Roddy and Simonin's study in its entirety at *http://journals.plos.org/plosbiology/article?id=10.1371/journal.pbio.2003706.*

HEALTHIER DIGGING TECHNIQUES

Regardless of a gardener's age, level of expertise, and amount of time they spend working in the garden, adopting better digging practices is imperative for avoiding injury, say researchers from Coventry University and the Royal Horticultural Society in the United Kingdom.

Researchers Barbara May, James Shippen, and Paul Alexander used a versatile motion tracking system to survey both amateur and professional gardeners as they showed off their digging stance in the lab as well as in garden settings. By analyzing the forces acting on joints and muscles while digging, the team pinpointed which areas of the body were being overworked and thus prone to injury.

According to May, it is crucial for gardeners to keep their spade or shovel as close to their bodies as possible while digging. The farther a gardener is positioned from the actual tool, the greater the strain and injury risk to their spine, shoulders, and lower back. Also, if the digger's back is stretched or twisted too intensely and repeatedly, the gardener is more susceptible to chronic injuries.

To avoid injury while digging, gardeners should keep their tools close to their bodies.

This new knowledge is beneficial for a couple of reasons. For professional gardeners who work long, physically intensive hours, adopting healthier digging techniques will reduce time lost due to injury. For amateur gardeners, young and old, practicing proper digging techniques will keep them gardening—a healthy form of exercise—later into life.

To read a summary of the study published in *HortTechnology,* visit *http://horttech.ashspublications.org/content/27/6/746.*

STUDY REVEALS ANESTHETICS AFFECT PLANTS

According to a December 2017 study published in the *Annals of Botany*, plants respond to anesthetics in much the same way that humans and other animals do. A team of six researchers from Germany, the Czech Republic, and Italy used a single-lens reflex camera to document the movement of plants before, during, and after experiencing anesthesia. They discovered that plants lose their ability to

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move autonomously and in response to touch while under the influence of the anesthetics.

For the purposes of the study, the researchers selected plants that perform detectable movements such as sensitive plant *(Mimosa pudica)*, peas *(Pisum sativum)*, Venus flytraps *(Dionaea muscipula)*, and sundews *(Drosera* spp.). Anesthetics administered included diethyl ether—in gaseous form—and lidocaine in a solution.

When the researchers applied the anesthetic to Venus flytrap, the plant's traps did not close when their trigger hairs were touched, as they normally would. Researchers also tested the effects of anesthetics on garden cress *(Lepidium sativum)*

Researchers used many plants as test subjects for their anesthesia study, including sundews *(Drosera* spp.) like this one.

seeds germinating in a petri dish. They observed that the seed germination process took longer than normal, and chlorophyll, important to light absorption during photosynthesis, accumulated at a slower rate under the effects of the anesthetic.

If you're wondering about the purpose of all this research—and whether the scientists asked the plants to count backwards from 10 after administering the anesthetic—one of the possible ramifications is that plants could replace animals in testing new anesthetics. "Plants emerge as ideal model objects to study general questions related to anesthesia, as well as to serve as a suitable test system for human anesthesia," concluded the study's authors.

For more information on the study, visit *https://academic.oup.com/aob/advance-article/doi/10.1093/aob/mcx155/4722571*.

PEOPLE and PLACES in the NEWS

LINDER TAKES HELM OF SAN FRANCISCO BOTANICAL GARDEN SOCIETY

Stephanie Linder has been named executive director of the San Francisco Botanical Garden Society (SFBGS). "The Board of Trustees is delighted to welcome Stephanie as our new executive director," says Delle Maxwell, SFBGS Board Chair. "She brings the perfect mix of experience with gardens, parks, and conservation and environmental organizations, as well as public-private partnerships similar to ours. Her skills, enthusiasm, and vision will guide the Garden forward during this new chapter of growth and development." Linder comes to SFBGS from the Santa Barbara Botanic Garden, where she was director of development and communications.

In conjunction with San Francisco Recreation and Parks, the SFBGS oversees operations of the San Francisco Botanical Garden at Strybing Arboretum, located within Golden Gate Park.

BALICK AWARDED DAVID FAIRCHILD MEDAL FOR PLANT EXPLORATION

Michael J. Balick, a renowned ethnobotanist and medicinal plant expert at the New York Botanical Garden (NYBG) in the Bronx, New York, has been awarded the 2018 David Fairchild Medal for Plant Exploration by the National Tropical Botanical Garden (NTBG). The Hawaii-based NTBG recognized Balick for a career spanning more than four decades of botanical fieldwork and research around the globe. Balick, who is vice president for botanical science and director and philecology curator of the Institute of Economic Botany at NYBG, has written or edited more than 25 books, including *Plants, People, and Culture: The Science of Ethnobotany* (W.H. Freeman, 1996), and *Rodale's 21st Century Herbal: A Practical Guide for Healthy Living Using Nature's Most Powerful Plants* (Rodale Press, 2014).

NEW DATABASE INCLUDES A THIRD OF THE WORLD'S PLANT SPECIES

Historically, plant databases have often been compiled and maintained by different organizations. Now, researchers collaborating with the Missouri Botanical Garden (MOBOT) in St. Louis have consolidated all the information on known native plant species in the Americas in a publicly searchable database called Tropicos.

In a paper published in the journal *Science* in December 2017, the researchers announced that the database contains some 125,000 species, which represents one-third of the world's vascular plants. At the current rate of more than 700 new plants discovered annually in the Americas, researchers estimate that the total will reach 150,000 species by the year 2050.

Other takeaways from the new database are that plant diversity is greatest in South and Central America and Mexico. The largest plant family is the orchid family (Orchidaceae), followed by the aster family (Asteraceae). This consolidated database is expected to be a valuable resource for scientists and researchers around the world.

Next, researchers from MOBOT and more than 40 other institutions are tackling a project called World Flora Online, in which they hope to chart the other two thirds of known plant life by the year 2020.

To learn more about the database, go to *www.futurity.org/vascular-plant-database-americas-1644882/*.

Written by Editorial Intern Mackenzie Nichols.

LEFT: REBEKAH D. WALLACE, UNIVERSITY OF GEORGIA, BUGWOOD.ORG. TOP RIGHT: ELIZABETH PEPIN SILVA, COURTESY OF AMERICAN PUBLIC GARDENS ASSOCIATION. BOTTOM RIGHT: COURTESY OF NEW YORK BOTANICAL GARDEN